

**REMARKS****Specification Amendment**

Specification has been amended to correct an error obvious to one of ordinary skilled in the art: the intersection of two light beams defines a volume, rather than a plane. Interference between two coherent beams also happens in a volume, rather than in a plane.

The Summary section of the specification has been amended to reflect the amendments made in Claims 1 and 2 (clarifying the definition of the axis of azimuthal rotation as passing through a selected storage location). This amendment is supported by page 11, lines 23-28 of the present specification ("This intersection of the mutually coherent reference and the object beams at the selected location...").

These amendments introduce no new matter.

**Claim Amendments**

Claims 1, 21, 27, 47 – 49, 56 and 72 have been amended to recite either one or both: that the aspherical reflecting surface has two focal points, and that one of the foci is located at or near the surface of the recording media. Original Claim 48 has been further amended to more precisely define an object beam as the object beam used to record said selected multiplexed hologram. Support for these amendments is found throughout the specification and the drawings and, in particular, in Claims 47 and 48 as originally filed. The recitation of one of the foci being "at or near" the surface of the recording media can be found on page 14, line 3 and is further supported by the drawings.

Claims 1 and 2 have been amended to clarify that the axis of azimuthal rotation is passing through a selected storage location. This amendment is supported by page 11, lines 23-28 of the present specification ("This intersection of the mutually coherent reference and the object beams at the selected location...").

Claims 21, 27, 36, 47 and 48 have been amended to define the axis about which the azimuthal angle is measured consistent with Claim 1. Support for this amendment is found throughout specification, and for example, in Claim 1 as originally filed.

Claims 28, 29 and 48 have been amended to more precisely define integers a and b as independently selected, consistent with Claims 1 and 2, which introduce azimuthal and planar angles as independent angles.

Claims 49 and 72 have been amended to more particularly define the claimed device of the present invention. Specifically, a recording media is a working body rather than an element of the device itself.

Claims 4, 6, 12-15, 18-20, 30, 31, 36, 38-40, 57, 68 and 71 have been amended to correct dependencies and typographical errors.

New Claims 77 through 85 have been added.

New Claim 77 incorporates the subject matter of Claim 30 and is dependent on Claim 29. Similarly, Claim 78 incorporates the subject matter of Claim 31 and depends on Claim 29.

New Claims 79 and 82 are essentially the original Claims 49 and 72, respectively. Claims 80 and 83 further incorporate the definition of an azimuthal angle as recited in Claim 1 as amended. Claims 81 and 84 incorporate the subject matter claimed in the original Claims 23, 31 and 76 as well as the subject matter described on page 18, lines 3 to 6 of the specification as filed.

New Claim 85 is drawn to the subject matter of the original Claim 76 and to the subject matter described on page 18, lines 3 to 6 of the specification as filed.

These amendments introduce no new matter.

#### Summary of Applicants' Invention

The instant invention is an apparatus for recording holographically stored information comprising at least a portion of an aspherical reflecting surface having two foci. One of the two foci of the aspherical reflecting surface (the first focus) is located on a surface of or within a recording media. An example of an aspherical reflecting surface is an ellipsoidal mirror.

Referring to FIGs. 1A, 3, 5A, 6 and 7, in some embodiments, the apparatus comprises an aspherical reflecting surface having two foci and at least one additional reflecting surface (a first additional reflecting surface).

The additional reflecting surface (the first additional reflecting surface) is located at or near either (i) the second focus of the aspherical reflecting surface or (ii) a mirror image of the second focus, where this mirror image is formed by a second additional reflecting surface (see FIGs. 5A, 6 and 7).

The additional reflecting surface (the first additional reflecting surface) can be rotated around at least one axis to allow recording azimuthally multiplexed, planar-angle (angularly) multiplexed and/or shift multiplexed holograms.

The present invention is also a method of using such an apparatus. The apparatus and method can be used to record azimuthally multiplexed, planar-angle (angularly) multiplexed and shift multiplexed holograms.

#### Reply to Restriction Requirement

The Examiner restricted the original claims to three groups. Group I includes Claims 1-48, drawn to a method of recording/reading multiplexed holograms. Group II includes Claims 49-75, drawn to an apparatus for recording/reading multiplexed holograms. Group III includes Claim 76, drawn to an information storage device.

Applicants note that new Claims 77-80 fall into Group II, while new Claim 81 falls into Group III.

With respect to Groups I and II, the Examiner stated that the claimed process and apparatus are related as a process and an apparatus for its practice. The Examiner stated that because the process of Group I may be practiced by an apparatus materially different from the apparatus of Group II, the inventions of Groups I and II are distinct.

It is Applicants' understanding that the Examiner asserted that the process of Group I may be practiced by an apparatus in which a motive device rotates the additional reflective surface (referred to as the first additional reflective surface in the Summary of Invention, see above) about two axes so that the rotation about the first axis is *dependent* from the rotation about the second axis. The Examiner further stated that these two *dependent* axes of rotation are perpendicular. If Applicants are incorrect, clarification is requested.

#### *I. Applicants Provisionally Elect the invention of Group II*

Responsive to the restriction requirement, Applicants provisionally elect the invention of Group II (Claims 49-75). This is a provisional election pending the outcome of the traversal of the instant restriction. Applicants reserve the right to file a continuing application or take such other appropriate action as deemed necessary to protect the non-elected inventions. Applicants do not hereby abandon or waive any rights in the non-elected inventions.

Responsive to the Requirement for Election of Species, Applicants elect the species of the device shown in FIG. 1A. Claims readable on the elected species are Claims 49-63 and 65-67.

Applicants note that this election is for the purposes of searching and that upon allowance of the generic claim, Applicants will be entitled to consideration of claims dependent on the generic claim and drawn to non-elected species. 37 C.F.R. 1.141.

## *II. Applicants Traverse the Restriction of Groups I and II.*

Applicants respectfully disagree with the Examiner and traverse the restriction requirement as to Groups I and II.

Applicants first note that Claims 1 and 49 have been amended to recite that the aspherical reflecting surface has two focal points. As amended, Claim 1 defines a method of recording multiplexed holograms comprising at least the following steps:

- reflecting either an object beam or a reference beam from an aspherical reflecting surface having two focal points, followed by recording a first hologram at a selected storage location;
- rotating the portions of the reference beam and the object beam impinging on a recording media at the selected storage location by a pre-defined azimuthal angle about an axis that lies in the plane formed by the impinging portions of the beams, while the angle between impinging portions of the beams is kept constant; and
- recording a second hologram in the same storage location, which is azimuthally multiplexed with respect to the first hologram.

As Applicants noted in the Summary of the Invention (see above), one of the two foci of the aspherical reflecting surface (the first focus) is located on a surface of or within a recording media. The additional reflecting surface (the first additional reflecting surface) is located at or near either (i) the second focus of the aspherical reflecting surface or (ii) a mirror image of the second focus, where this mirror image is formed by a second additional reflecting surface (see FIGs. 5A, 6 and 7).

Considering, for simplicity, an embodiment in which the additional reflecting surface (the first additional reflecting surface) is located at or near the second focus of the aspherical reflecting surface and is the one being rotated (see, e.g., FIG. 1A), it is easy to see that in order to

rotate the portions of the reference beam and the object beam impinging on a recording media at the selected storage location by a pre-defined azimuthal angle about an axis that lies in the plane formed by the impinging portions of the beams, while the an angle between impinging portions of the beams is kept constant, it is necessary to rotate the additional reflecting surface (the first additional reflecting surface) in such a way that neither the angle between the impinging portions of the beams changes, nor the additional reflecting surface itself shifts away from the second focal point of the aspherical reflecting surface. Such a rotation is properly described in Claim 49 as a rotation about a first axis, which is *independent* of another (second) axis. As a matter of convenience, the first and the second axes are chosen perpendicular to one another<sup>1</sup>.

Indeed, if the additional reflecting surface (the first additional reflecting surface) were rotated about the first axis in a manner *dependent* on rotation about another axis (as the Examiner proposes), then the additional reflecting surface would, *as a consequence* of the first rotation, necessarily either affect the angle between the impinging portions of the beams, or shift the additional reflecting surface away from the second focal point of the aspherical reflecting surface. This however, would *not* be a method as defined by Group I.

Accordingly, Group II, and for example Claim 49 as amended, defines an apparatus that comprises at least the following elements:

- a portion of an aspherical reflecting surface having two focal points;
- an additional reflecting surface (first additional reflective surface); and
- a motive device for rotating at least one of either at least one portion of the aspherical reflecting surface or the at least one additional reflecting surface about a first axis, and *independently*, about a second axis.

Applicants submit that the method defined by Group I cannot be practiced by an apparatus that is materially different form the one defined by Group II. Reconsideration, withdrawal of the restriction requirement and rejoinder of Groups I and II are respectfully requested.

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<sup>1</sup> Applicants appreciate that where a body rotates independently about two perpendicular axes, the same rotation would not be independent with respect to two axis that are not perpendicular. However, as Examiner will undoubtedly appreciate, it is always possible to choose a Cartesian frame of reference. Thus, a device in which the two independent axes are not perpendicular is *not materially different* from a device in which the two independent axes form the right angle.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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